

ADA 048948 WARL-TR-75-50-VBL-111 USAF BIOENVIRONMENTAL NOISE DATA ANDBOOK, Volume 111 MC-1A Motor-Generator, Mobile Technical upt. Approved for public release; distribution unlimited.

> AEROSPACE MEDICAL RESEARCH LABORATORY AEROSPACE MEDICAL DIVISION AIR FORCE SYSTEMS COMMAND WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

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FOR THE COMMANDER

HENNING E. VON GIERKE

Director

Biodynamics and Bionics Division

Aerospace Medical Research Laboratory

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The MC-lA Motor-Generator is an electric motor-driven unit designed to furnish AC and DC electrical power for use in aircraft hangers. This report provides measured data defining the bioacoustic environments produced by this unit operating inside a large aircraft hanger at normal rated/loaded conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived

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noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, /USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application, AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. included to transport that with some contract to the state of the state of the state of the state of

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## PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 723104, Measurement and Prediction of Noise Environments of Air Force Operations.

The author acknowledges the efforts of Mr. Robert T. England and Mr. Robert G. Powell who conducted the field measurements, and Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report. Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton assisted in the mechanics of data processing, and Mrs. Norma Peachey typed and prepared the graphics.

List of Figures

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### INTRODUCTION

The MC-1A Motor-Generator is an electric motor-driven unit designed to furnish AC and DC electrical power for use in aircraft hangers.

This volume provides measured data defining the bioacoustic environments produced by this unit. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the MC-1A generator.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during ground operations of aircraft, ground support equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Volume 2 provides a method and data for adjusting the handbook's far-field noise data, which are for standard meteorological conditions (15C temperature, 70% rel humidity, 0.760 meters Hg barometric pressure) to derive comparable data for other meteorological conditions. Refer to Volumes 1 and 2 (references 1 and 2) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., inflight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; Autovon 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

- 1. Cole, John N., USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.
- 2. Cole, John N., USAF Bioenvironmental Noise Data Handbook, Volume 2: Procedure to Evaluate Effects of Non-standard Meteorological Conditions on Far-Field Noise, AMRL-TR-75-50 (2), AMRL, WPAFB, OH, 1975.

### **NEAR-FIELD NOISE**

#### **MEASUREMENTS**

A standard MC-1A Motor-Generator was operated inside, and approximately in the center of a large aircraft hanger (190.5 m long  $\times$  95.1 m wide  $\times$  18.3 m high) on a concrete floor at normal rated/loaded conditions. The hanger walls and ceiling were not acoustically treated. No aircraft were in the vicinity of the unit while being measured. No far-field acoustic data were acquired because of the relatively close proximity of the hanger walls. The load bank was physically located so as to not interfere with the MC-1A noise field.

Figure 1 identifies 36 noise measurement locations at a height of 1.5 meters above the concrete apron (nominal ear level of ground crew). The 0 degree reference direction passes through the tow bar. These locations are in the acoustic near-field of the source where the sound wave fronts generally do not spherically diverge and the source appears to be spatially distributed (i.e., not a point source). Consequently, these near-field data cannot be extrapolated to longer distances but do properly define the levels at locations close to the unit.

Near-field measurements were also made at ear level at the operator control panel. Table 1 lists the numeric/alphabetic designators used on the data pages in this report to identify the operator measurement location and test conditions. The designator 1/A means operator location 1 and test condition A. Such a descriptor is essential in many handbook volumes that involve multiple combinations of locations/conditions. It is used in this report to maintain format consistency.

#### RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced by the MC-1A unit at the 37 specified, near-field locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data one can calculate the variety of measures in Table 3 which are widely used to assess the effects of noise on personnel and their performance.

For data at other intermediate near-field locations (i.e., for radial distances less than 4 meters) you can interpolate between the 36 measured data points.

#### TABLE 1

MEASUREMENT LOCATION AND TEST CONDITION FOR OPERATOR NOISE MEASUREMENTS

MC-1A Motor-Generator, Edwards AFB, 22 Sep 1972

Measurement Location

1

Operator Control Panel

Operation

A

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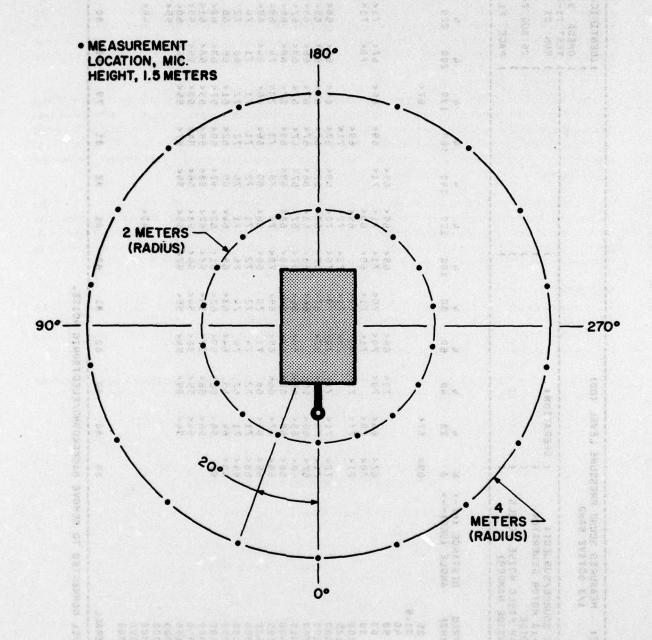


Figure 1. Measurement Locations

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125		725	716	71.6	707	714	>21	724	494	717	6.84	684	684	25
200	0	714	704	>69	674	674	529	>19	674	>29	229	229	654	67.
250		>29	>99	>99		999	289	684	<b>99</b>	674	229	299	99	69
315		68 <	684	> 29	>99	<b>99</b>	>19	67¢	674	674	674	<b>68</b> ¢	674	99
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2500			244	22<	264	244	244	584	>95	244	534	264	264	69
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200			73	684	72	>69	>99	72	>69	204	73	>19	75	92	75
630			>99	>99	>99	<b>999</b>	>49	634	9	>99	89	89	99	99	7.0
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1250			29	99	29	79	<b>90</b>	634	69	77	73	69	69	2	11
1600			249	65	634	614	264	624	99	634	634	634	99	65	99
2000			624	614	>65	284	264	254	574	614	624	<b>90</b>	614	614	634
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NOISE SOURCE/SUBJECT: MC-14 MOTOR GENERATOR, MOBILE NEAR FIELD NOISE LEVEL (INSIDE HANGER) DISTANCE (M) FREQ ANGLE (DEG)- (HZ)												
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00		724	724	244	144	144	244	244	244	754	734	784
100		704	714	714	714	714	714	724	734	734	734	734
150		707	707	207	707	717	704	716	704	694	704	7.00
200		684	×69	674	999	684	999	654	999	674	>69	704
250		>19	>19	>19	>69	204	>69	>69	>69	704	704	724
315		12	22	22	714	1.4	14	22	74	724	714	23
004		12	724	22	9.	2	11	15	16	734	714	92
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2000		>09	<b>909</b>	584	<b>60</b> ¢	99	69	>49	924	624	294	69
2500		584	574	584	624	29	65	49	49	624	584	99
3150		254	294	574	<b>90</b>	9	63	63	624	624	574	99
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200		7.1	72	72	23	72	73	75	11	75	73	15	72	7.8
1000		20	42	73	22	92	77	7.4	28	75	7.4	73	92	76
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0000													19	62
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0000	OME 39400	75	61	3	61				23	29	3	3	2	29
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250 250 200 200 200 200 200 200 200 200		22232	8222	22222	20223	22228	22222	252232	22223	25223	22252	7 6 8 3 7 6 8 3 7 6 8 3 7 6 8 3 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
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	N 08)	98	9	:	*	96	68	96	8	18	:	60	93

. BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

3											) ONEGA	5A 3.	ONEGA 3.2
NOISE SOURCE/SUBJECT: MC-1A MOTOR GENERATOR, MOBILE MEAR FIELD NOISE LEVELS (INSIDE MANGER)		OPERATIONS	ž			^^^^		8 3	i 2	S 5	TEST RUN 26 AU	ST 71-020-	20-360
DISTANCE (M) ->	56	586	300	328	3 6 6	~-	20	23	~ 5	~ ° °	2 100	120	150
TO PROTECTION WEIGHTED OVERALL WEIGHTED OVERALL WEIGHTED OVERALL	SOUND LE SOUND LE TIME (T	LEVEL COA LEVEL COA (T IN MIN	COASLC IN COASLA IN MINUTES)	285	FAT	SURE	PER DAY	S & S	161-35,	700	£	19	
NO PROTECTION DASLG OASLA	262	182	282	m 0 0		295	22	22	98	33	**	92	400
HINIMUM QPL EAR HUFFS OASLA*	2 %	57	2 2	2 %	2 2	3	2 65	3		209	209	19	9 5
AMERICAN OPTICAL 1700 E	960 EAR HUF	FS 53	960	960	960	966	96	2 2		968	960	96	960
V-51R EAR PLUGS DASLA*	36	36	2 20	20 20	2 3			3 2			2 2	, ,	5 6
1700	960 EAR HUFFS	968 FS PLUS	960 V-51R	EAR P	960 1068	96 4	96	196		196	3 1	2 3	196
NO COMMU	960 NICATION UNI 52 960	ຄື ຄ	961	96 196	96 25 96	96 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	961	36 38		960	3 4 3	3 13	96 23
COMMUNICATION PREFERRED SPEECH INTE PSIL	INTERFERENCE 73	CE LEVEL	L (PSIL 72	12 Z	69	. 2	2	2	2	2	2	2	2
ANNOYANCE PERCEIVED NOISE LEVEL, TONE CORRECTION (C IN PNLT	LEVEL, TONE (C IN 08)	CORRECTED (PNLT IN PNDB) 89 89 92 89 1 2 3 3	89 89	92 92 3	99 3	5 0	60	g m	<b>*</b> ~	*~	20	8-	2"

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NOISE SOURCE/SUBJECT: MG-1A MOTOR GENERATOR, MOBILE NEAR FIELD NOISE LEVELS (INSIDE HANGER)		OPERATIONS			68 89 89 68 89 89	2222	2 2	t 4	å. 2	\$	RUN 26 AL	25 9 -	96-360
DISTANCE (M) -> ANGLE (DEG)>	160	180	200	220	240	260	280	300	320	25.0	OPERATOR LOCATION TEST CONDITION	R LOCA ONDITI	NON
HAZARD/PROTECTION C-NEIGHTED OVERALL SO A-NEIGHTED OVERALL SO MAXTMIN PEDMISSTRE F	SOUND LE SOUND LE	LEVEL (OF	COASLC IN	080	AT EAR AT EAR NE EXPOSIBE		0.840	1000	2 4 4	がま 型を	100	960	
			123	200			225	222	\$ 25		14 3	245	84 8
MUFFS	98		196	960	960	960	996	96	39	828		28	
AMERICAN OPTICAL 1700 EA OASLA* T V-51R EAR PLUGS	960 960	2	986	960	960	986	986	960	960	960	12 PM 1	22	
CAL 1		961 FS PLUS 42	960 43 43 960	960 960 960	960	96 9 96 9 96 9	960 496	960	96 96 96 96 96 96 96 96 96 96 96 96 96 9	960	9.9 × 3.3 ×	55 38	
H-133 GROUND COMMUNICATION OASLA*  GOMMUNICATION PREFERRED SPEECH INTERFE	ICATION UNIT 51 960 INTERFERENCE	IIT 51 960 ICE LEVEL	53 960 1. (PSIL	25 NA	96 96	960	48 4	960 %	960	960	20 0 N	988	25 45, 127 147
VED NOISE L			7ED (P	95 J	P P 808	<b>*</b> **	2 %=	8 %	. R.	ر ا د	# a ##!	. F.	1